

IN THE CLAIMS

The following claim set replaces all prior versions, and listings, of claims in the application:

1. (Previously Presented) A modulator for use in gas chromatographic analysis, adapted for alternatively trapping and releasing fractions of solutes in a length of a capillary column within a chromatographic oven, said modulator comprising at least one nozzle placed to spray at least one jet in at least one corresponding place along said capillary column length, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time.

2. (Previously Presented) A modulator according to claim 1, each said related valve is alternatively opened for a predetermined time within a given cycle time and wherein said column place is heated by the oven atmosphere during the remaining cycle time.

3. (Previously Presented) A modulator according to claim 2, for trapping and releasing in sequence fractions of solutes, wherein said modulator comprises at least two nozzles placed to spray liquid CO₂ jets in at least two corresponding separated places along said capillary column length, and means for alternatively opening each of said valves each associated with said nozzles for a predetermined time in sequence within a given cycle time, to cause each jet of liquid CO₂ to impinge for said predetermined time on the corresponding column place and to leave the oven atmosphere to heat said column place during the remaining cycle time.

4. (Original) A modulator according to claim 3, wherein said predetermined time is the same for all valves.

5. (Original) A modulator according to claim 3, wherein said predetermined time is different for at least two of said valves.

6. (Previously Presented) A modulator according to claim 4, wherein said predetermined time ranges from about 0.1 seconds to about 30 seconds.

7. (Previously Presented) A modulator according to claim 4 wherein said cycle time is the sum of the predetermined times of all valves.

8. (Previously Presented) A modulator according to claim 2, wherein said cycle time ranges from about 0.1 seconds to about 30 seconds.

9. (Previously Presented) A modulator according to claim 1, wherein each said nozzle has an opening in the form of a slit parallel to said capillary length.

10. (Previously Presented) A modulator according to claim 9, wherein said slit is about 0.04 mm wide and about 3 mm long.

11. (Previously Presented) A modulator according to claim 1, wherein each said nozzle is formed by a set of capillaries aligned in parallel to said capillary column length.

12. (Previously Presented) A modulator according to claim 11, wherein an upstream end of said capillaries open in a common CO₂ feeding duct, to which the capillaries are glued or soldered.

13. (Original) A modulator according to claim 12, wherein said capillaries each have an inner diameter of the order of 0.11 mm and each set forms a curtain having a length of about 3 mm.

14. (Currently Amended) A modulator according to claim 1, wherein each said nozzle is inserted in a metal socket.

15. (Original) A modulator according to claim 14, wherein said socket is in the form of a brass tube.

16. (Previously Presented) A modulator according to claim 1, wherein said column length is mounted in stretched conditions.

17. (Previously Presented) A gas chromatographic analysis method for a comprehensive two dimensional gas chromatographic system having first and second chromatographic columns, said method comprising the steps of:

- (a) providing a modulator having at least one nozzle placed to spray at least one jet in at least one corresponding place along a capillary column length of said first chromatographic column, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time; and
- (b) operating the modulator to modulate solute fractions issued by said first chromatographic column to be fed to said second chromatographic column in a said comprehensive two dimensional gas chromatographic system.

18. (Previously Presented) A gas chromatographic analysis method for a gas chromatographic system having a chromatographic column and an injector for injecting gas into the chromatographic column, said method comprising the steps of:

- (a) providing a modulator having at least one nozzle placed to spray at least one jet in at least one corresponding place along a capillary column length of said chromatographic column, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time; and
- (b) operating the modulator to modulate injected fractions immediately downstream the injector in a said gas chromatographic system.

19. (Previously Presented) A gas chromatographic analysis method for a gas chromatographic system having a chromatographic column and a detector for detecting eluting fractions from the chromatographic column, said method comprising the steps of:

- (a) providing a modulator having at least one nozzle placed to spray at least one jet in at least one corresponding place along a capillary column length of said chromatographic column, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time; and
- (b) operating the modulator to modulate eluting fractions from a gas chromatographic column immediately upstream of the detector of a said gas chromatographic system.

20. (Previously Presented) A comprehensive two dimensional gas chromatographic system comprising:

first and second chromatographic columns operatively connected so that said second chromatographic column receives solute fractions issued by said first chromatographic column; and
a modulator having at least one nozzle placed to spray at least one jet in at least one corresponding place along a capillary column length of said first chromatographic column, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time, wherein said modulator is operatively positioned with respect to said first and second chromatographic columns so as to modulate the solute fractions issued by said first chromatographic column to be fed to said second chromatographic column.

21. (Previously Presented) A gas chromatographic system comprising:

a chromatographic column having a capillary column length and an injector for injecting gas into the chromatographic column; and
a modulator having at least one nozzle placed to spray at least one jet in at least one corresponding place along a capillary column length of said chromatographic column, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time, wherein

said modulator is operatively positioned with respect to said chromatographic column so as to modulate injected fractions immediately downstream of the injector.

22. (Previously Presented) A gas chromatographic system comprising:
- a chromatographic column having a capillary column length and a detector for detecting eluting fractions from the chromatographic column;
 - and
 - a modulator having at least one nozzle placed to spray at least one jet in at least one corresponding place along a capillary column length of said chromatographic column, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time, wherein said modulator is operatively positioned with respect to said chromatographic column so as to modulate the eluting fractions from the gas chromatographic column immediately upstream of the detector.

23. (Currently Amended) A gas chromatographic system which comprises a chromatographic oven having a capillary column therewithin, and at least one modulator as in claim 1 adapted for alternatively trapping and releasing fractions of solutes in a length of the capillary column within the chromatographic oven, said modulator comprising at least one nozzle placed to spray at least one jet in at least one corresponding place along said capillary column length, wherein each said nozzle is connected to a source of liquid CO₂ via a related valve, and means for alternatively opening said related valve for a predetermined time, to cause a jet of liquid CO₂ to

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impinge for said predetermined time on said column place and to leave the oven atmosphere to heat said column place after said predetermined time.